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Risk factors for preoperative seizures in meningiomas - base versus non-bases of supratentorial. Single centre retrospective study in a series of 244 cases

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Keywords
seizure,
skull base meningioma,
supratentorial meningioma,
oedema

Abstract

Background: Meningiomas are the most frequent benign intracranial lesions. The literature review reported that 19-63% of the patients with meningioma suffer from preoperative seizures, and 35% experience epileptic seizures as the initial symptom. The present study attempted to establish the risk factors for seizures before surgery of supratentorial meningiomas.

Objective: To compare predictive factors for preoperative seizures for skull base meningiomas (SBMs), with non-skull base meningiomas (NSBMs).

Materials and methods: The clinical data of 244 patients with supratentorial meningiomas treated microsurgically between 2007 and 2018 were analyzed retrospectively. There were two groups; Group "A" with (NSBMs) and Group "B" with (SBMs). Demographic, clinical, imaging, histopathological, and electroencephalographic data were assessed. Univariate statistical analyses were performed among factors that might correlate with preoperative seizures.

Results: A total of 244 patients with a diagnosis of intracranial meningioma were retrospectively evaluated. The mean age was 54.34 years (range 16- 84), females 165, meals 79. Of these 154 patients for the non-skull base, seizures in 65 (42.2%), whereas, 90 patients for skull base, with 32 (35.5%) patients with seizures. The groups had similar preoperative seizure occurrence in relation to age (p=0.154, p=0.819), gender (p=0.396, p=0.445) tumor size (p=0.318, p=0.244), tumor side (p0.836, p=0.702) for Group A and B respectively. The pre-op seizure was the third presentation in both groups after non-focal symptoms and (FND) respectively. For Group "A" seizure as the initial symptom was in 49.2% of patients versus 50.8% for others, while in Group "B" was in 37.5% vs 62.5%.

The both groups had statistically significance between PTBE and pre op seizure, for Group "A", PTBE was in 93(60.4%) patients, (seizure in 51patients 78.5%) vs (42 patients 47.2% for non-seizure), (?2=15.356, p=0.000). For Group "B", PTBE was in 43(47.8%) patients, (seizure in 25 patients 78.1%) vs(18 patients 31% for non-seizure),(?2=18.328, p=0.000).

The most frequently seizure for Group "B" was in OGM (seizure 25% vs 13.8 without seizure) and SWM (seizure 71.8% vs 65.5% non-seizure), while lesser overall in planum/tuberculum (seizure3.2% vs 20.7% non-seizure). There was a statistically

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significant relationship between tumour location and preoperative seizure for (SBM), ($?^2$=5.985, p=0.050) while absent in Group "A". (?2=1.373, p=0.503). There were no differences between the two groups with WHO grade and pre-op seizure. The unexpected finding in this study is that the presence of preoperative neurologic deficits has been less frequently associated with preoperative seizures in both groups. Careful analysis and further investigation are needed.

Conclusion: We identified that the major risk factor for pre-op seizure in both group studies is PTBE, and location for skull base meningiomas, where the planum/tuberculum lesser overall risk for pre-op seizure. While other radiological and histopathological factors are statistically non-significant. Interestingly, the factors associated with preoperative seizures were the absence of preoperative neurologic deficits for both groups.

Introduction

Meningioma is the most common benign intracranial tumor, accounting for approximately one-third of all CNS tumors [32]. In the literature review; it was reported that 19-63% of the patients with meningioma are suffered from preoperative seizures, and 35% of them experience epileptic seizures as the initial symptom [19]. Interestingly, patients with meningioma experience seizures even more frequently than patients with primary glioblastoma or brain metastasis. This is in particular a high rate taking into account that meningiomas are extra-axial tumors [31].

Recurrent seizures in patients with brain tumors lead to significant morbidity, cognitive problems, inability to drive, and diminished quality of life [11,25,29]. For patients with meningioma, surgery is the main treatment modality and offers the possibility of a cure. However, complications and morbidity from meningioma surgery are common [3, 23, 26,27]. The mechanisms of tumor-induced seizures are poorly understood. The causative neoplasm may act as a generator to produce an epileptogenic focus in the peri-tumoral brain. The mechanisms of epileptogenesis pre and postoperative are not sufficiently known. Distortion of the cortical structures may be the generator areas for focal seizure [6,12,17,30,34]

The following retrospective study summarizes the most important identified risk factors for preoperative seizure in a series of 244patients who underwent surgery for supratentorial meningioma, and subsequently, compares between the skull base and non-skull base.

Materials and methods

General information. Between 2007 and 2018, a total 244 of patients with supratentorial meningiomas were treated in Uzhhorod Neurosurgical Center. Pediatric(<16 years), recurrent and multiple meningioma patients, also posterior fossa meningiomas included; (clival,petro clival, foramen magnum, tentorial and cerebellopontine angle) were excluded from statistical analysis in this study. They were 244 patients divided into two groups: Group "A" (NSBMs) included 154 patients with preoperative seizure (65 patients) versus non-seizure (89 patients), and Group "B" (SBMs) included 90 patients, with preoperative seizure (32 patients) versus non-seizure (58 patients).

Clinical data collection. The medical records of all the patients were checked for history and initially preoperative seizures. All the patients had been diagnosed by head contrast-enhanced magnetic resonance imaging and/or computed tomography scans, and the maximum tumor size, tumor site and any peritumoral brain edema (PTBE), by employing high signal intensity changes on T2-weighted images, were preliminarily determined. We classified tumor size into 4 categories according to MRI findings; small (3cm and less), medium (3cm and less- 5cm), large (5cm-6cm), and giant (more 6 cm). All patients with preoperative seizures had been diagnosed by interictal 19 channel scalp electroencephalography (EEG). Craniotomy for meningioma resection was performed microscopically for all 244 patients.

After the resection of the tumor histopathological and immune histochemical analysis, were performed, according to WHO classification of tumors of the central nervous system,

We have analyzed the articles and summarized all risk factors investigated and subdivided risk factors for preoperative seizures into NSBMs and SBMs.

Results are summarized in (Table 1) NSBMs Group "A" and in (Table 2) for SBMs. Group "B"

Statistical analysis; Statistical analysis was performed using Chi-square test, t-test, and Fisher's Exact test. P <0.05 was considered statistically significant. Comparison between the two groups in relation to age, sex, tumor location, tumor site, tumor side, tumor size, histopathology, and clinical presentation was performed to identify predictive factors for preoperative seizure. Pearson Chi-square

statistics were used to examine the association between categorical variables (seizure and PTBE). There is a significant association at 5% significance level between seizure and PTBE of respondents (x2 =15.356, df=1, p=0.000) for Group "A", and (χ2=,18.328, df=1, p=0.000) for Group B.(seizure and location- for skull Base). There was a significant association at 5% significance level between seizure and location of tumor of respondents (x2 = 5.985, df = 2, p = 0.050).

Results

Demographic data

This study showed that meningioma in females had a higher tendency of 96 as compared to male 58, the ratio F/M was 1.6:1, and mean age 54.29 in Group "A". Like that in Group "B", the ratio F/M was 3.2:1.(female 69 vs 21 male), with a mean age of 54.49.

The patients' age ranged from 16 to 84 years old, the mean age for patients with seizures was 53.01 years (range 22 to 75), and 55.68 years (range 16-84) for non-seizure (χ2=3.737, p=0.154).

The seizure vs non-seizure for Group "A" female 58.4% vs 65.1%, while in male was 41.5% vs 34.8%. (χ2=0.720, p=0.396). There is a weak association was found between the male gender and pre-op seizure, however, the difference not reached statistically significant.

For Group "B", the seizure vs non-seizure in females was 81.5% vs 74.1% while in males was 18.5% vs 25.9%. (χ2=0.583, p=0.445). There is a weak association was found between female gender and pre-op seizure in Group "B". However, there was no statistically significant relationship between age or gender and preoperative seizure in both Groups.

Table 1. Factors associated with pre-op seizures in patients with NSBM Group "A"

Factor	No of cases n=154 (%)	Seizure n=65	No seizure n=89	P value
Sex Female Male	 96 (62.4%) 58 (37.6%)	 38 (58.4%) 27 (41.5%)	 58 (65.1%) 31 (34.8%)	0.396
Age/years < 40 40-60 >60	 20(13%) 76(49.4 %) 58(37.6 %)	 7 (10.7%) 38 (58.4%) 20 (30.7%)	 13 (14.6%) 38 (42.7%) 38 (42.7%)	0.154
Tumor size/ cm Small <3 medium >3- <5 large 5-6 giant >6	 37(24%) 59(38.3 %) 28(18.2 %) 30(19.5 %)	 17 (26.2%) 28(43%) 8 (12.3%) 12 (18.5%)	 20 (22.5%) 31 (34.8%) 20 (22.4%) 18 (20.3%)	0.318
Side LT RT Both/median	 74(48%) 73(47.4 %) 7(4.6%)	 33(50.8 %) 29(44.7 %) 3(4.5%)	 41(46%) 44 (49.4%) 4 (4.6%)	0.836
Location Convex Parasaital/Parafalx Intraventricular Site Frontal Fronto temporal Fronto parietal Temporal Tempo paraital Parietal Paraito occipital Occipital	 98(63.6 %) 51(33.1 %) 5(3.3%) 49(31.8) 17(11) 47(30.5) 7(4.5) 9(5.8) 12(7.8) 10(6.5) 3 (2)	 39(60%) 25(38.5 %) 1 (1.5%) 23(35.4 %) 6 (9.3%) 19 (29.2%) 4 (6.2%) 3 (4.6%) 6 (9.3%) 3 (4.6%) 1(1.5%)	 59(66.3 %) 26 (29.2%) 4 (4.5%) 26 (29.2%) 11 (12.3%) 28 (31.4%) 3 (3.3%) 6 (6.7%) 6 (6.7%) 7 (7.9%) 2 (2.3%)	0.503 0.683
PTBE Present Absent	 93(60.4 %) 61(39.6 %)	 51 (78.5%) 14 (21.5%)	 42 (47.2%) 47 (52.8%)	0.000

Imaging finding

Relation to location

In Group "A"; convex in 63.6% patients (seizure 60% vs 66.3% non-seizure), parasaital/ parafalx 33.1% patients (seizure 38.5% vs 29.2% non-seizure) and intraventricular 3.3% patients (seizure 1.5% vs 4.5% non-seizure), Parasagittal/ parafalcine location had higher occurrence of seizure in this group, however, there was no statistically significant relation between

tumor location and preoperative epilepsy, (χ2=1.373, p=0.503).

In Group "B" (Table 3.a, b); SWM in 67.8% patients (71.9% seizure vs 65.5% non-seizure), OGM in 17.8% patients, (25% seizure vs 13.8% non-seizure), and planum/tubeerculum in14.4% patients (3.1% seizure vs 20.7% non-seizure). Preoperative seizure was more incidence in OGM and SWM, respectively, while, lesser in planum and tuberculum meningiomas, (χ^2=5.985, p=0.05). There was statistically significant relation between tumor location and preoperative seizure for (SBM) Group"B", while absent in Group "A".

Table 2. Factors associated with pre op seizures in patients with SBM Group" B" 90

Factor	No of cases n=90 / %	Seizure n=32 (35.6%)	No seizure n=58 (64.4%)	p
Sex Female Male	69(76.7 %) 21(23.3 %)	26 (81.2%) 6 (18.8%)	43(74.1 %) 15 (25.9%)	0.44 5
Age/years < 40 40-60 >60	11(12.2 %) 58(64.4 %) 21(23.4 %)	3(9.3%) 21(65.6 %) 8(25%)	8(13.8%) 37(63.8 %) 13(22.4 %)	0.81 9
Tumor size/ cm Small 3 and <3 medium >3- <5 large 5-6 giant >6	27(30%) 28(31.1 %) 29(32.2 %) 6(6.7%)	12(37.5 %) 12(37.5 %) 7(21.9%) 1(3.2%)	15(25.8 %) 16(27.6 %) 22(38%) 5(8.6%)	0.24 4
Side LT RT Both/median	29(32.2 %) 32(35.6 %) 29(32.2 %)	12(37.5 %) 11(34.4 %) 9(28.1%)	17(29.3 %) 21(36.2 %) 20(34.5 %)	0.70 2
Location SWM/CS OGM Planum/Tubercul um	61(67.8 %) 16(17.8 %)	23(71.9 %) 8 (25%) 1 (3.1%)	38 (65.5%) 8 (13.8%)	0.05 0
	13(14.4 %)		12 (20.7%)	
PTBE Present Absent	43(47.8 %) 47(52.2 %)	25 (78.1%) 7 (21.9%)	18 (31%) 40 (69%)	0.00 0

Relation to Brain Lobes and Tumour Side

Preoperative seizure for (NSBM) occurred in all sites of brain lobes, moreover, there was a higher incidence of frontal (seizure 35.4% vs 29.1% non-seizure). However, There was no statistically significant relation between brain lobes lesion and preoperative seizure. (χ2=,0.288, p=0.687). According, to side of meningioma location in Group "A", right in 47.4% patients, (seizure 44.7% vs 49.4% non-seizure), left side in 48% patients (seizure 50.8% vs 46% non-seizure), and Medline both side in 6.4% patients, (seizure 4.5% vs 4.6 non seizure). There was no statistically significant relationship between the side of the lesion and preoperative seizure. (χ2=,0.358, p=0.836). While in Group "B" left side in 35.6% patients, (seizure 37.5% vs 29.3 non seizure), right side in 48% patients, (seizure 34.4% vs 36.2 non seizure), and Medline both side in 32.2% patients, (seizure 28.1% vs 34.5% non-seizure). Despite the weak relationship was found between the left side and pre-op seizure, however, there was no statistically significant relationship between the side of the lesion and preoperative seizure. (χ2=,0.707, p=0.702).

Table 3a. Location * Seizure. Cross tabulation for Group B

			SEIZURE		Total
			No	Yes	
LOCATION	SWM	Count	38	23	61
		Expected Count	39.3	21.7	61.0
		% within LOCATION	62.3 %	37.7 %	100. 0%
		% within SEIZURE	65.5 %	71.9 %	67.8 %
	OGM	Count	8	8	16
		Expected Count	10.3	5.7	16.0
		% within LOCATION	50.0 %	50.0 %	100. 0%
		% within SEIZURE	13.8 %	25.0 %	17.8 %
		Count	12	1	13

	PLA/TUBERCULUM	Expected Count	8.4	4.6	13.0
		% within LOCATION	92.3%	7.7%	100.0%
		% within SEIZURE	20.7%	3.1%	14.4%
Total		Count	58	32	90
		Expected Count	58.0	32.0	90.0
		% within LOCATION	64.4%	35.6%	100.0%
		% within SEIZURE	100.0%	100.0%	100.0%

Table 3b. Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.985[a]	2	.050
Likelihood Ratio	7.078	2	.029
Linear-by-Linear Association	2.170	1	.141
N of Valid Cases	90		

Chi-square statistics were used to examine the association between categorical variables (Seizure and Location- Skull Base). There is a significant association at 5% significance level between seizure and location of tumor of respondents (x2 = 5.985, df = 2, p = 0.050).

Relation to Tumor Size

Preoperative seizure was occurs in all different tumor size, for Group "A" small size was in 24% patients,(seizure 26.2% vs 22.5% non-seizure), medium 38.2% patients (seizure 43%vs 34.8% non-seizure), and large/giant in 37.7% patients (seizure 30.8% vs 42.7% non-seizure).The difference is statistically insignificant, ($\chi2=3.073$, p=0.381). While for Group" B", small size 30% patients,(seizure 37.5% vs 25.8%), medium 31.1% patients (seizure 37.5% vs 27.6%) and large/giant 38.8% patients (seizure 25% vs 46.5%). The difference is statistically insignificant($\chi2=4.167$, p=0.244).Despite the weak relation was found between small/medium size and pre op seizure, however, distribution of tumor size in both groups showed that there was no statistically significant relation between tumor size and occurrence of pre-op seizure.

Relation to PTBE

There was a higher incidence of peri-tumoral edema in seizure in both groups; for Group "A" (Table 4.a,b), PTBE was in 93(60.4%) patients,(seizure in 51patients 78.5%) vs (42 patients 47.2% for non-seizure). There was a statistically significant relation between peri-tumoral edema and pre-op seizure, ($\chi2=15.356$, p=0.000).For Group "B",(Table5.a,b) PTBE was in 43(47.8%) patients,(seizure in 25 patients 78.1%) vs(18 patients 31% for non-seizure). There was a statistically significant relation between peri-tumoral edema and pre-op seizure, ($\chi2=18.328$, p=0.000).The incidence of PTBE was higher in NSBM, however, distribution of PTBE in both groups showed that there was statistically significant relation between PTBE and occurrence of pre-op seizure .

Table 4a. Seizure * PTBE cross tabulation for group a

			PTBE		Total
			No	Yes	
SEIZURE	No	Count	47	42	89
		Expected Count	35.3	53.7	89.0
		% within SEIZURE	52.8%	47.2%	100.0%
		% within PTBE	77.0%	45.2%	57.8%
	Yes	Count	14	51	65
		Expected Count	25.7	39.3	65.0
		% within SEIZURE	21.5%	78.5%	100.0%
		% within PTBE	23.0%	54.8%	42.2%
Total		Count	61	93	154
		Expected Count	61.0	93.0	154.0
		% within SEIZURE	39.6%	60.4%	100.0%
		% within PTBE	100.0%	100.0%	100.0%

Table 4b. Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	15.356[a]	1	.000		
Continuity Correction[b]	14.077	1	.000		
Likelihood Ratio	15.962	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	15.256	1	.000		
N of Valid Cases	154				

Chi-square statistics were used to examine association between categorical variables (Seizure and PTBE). There is a significant association at 5% significance level between seizure and PTBE of respondents (x^2 =15.356, df=1, p=0.000).

Table 5a. PTBE * Seizure crosstabulation for Group B

			SEIZURE		Total
			No	Yes	
PTBE	0	Count	40	7	47
		Expected Count	30.3	16.7	47.0
		% within PTBE	85.1%	14.9%	100.0%
		% within SEIZURE	69.0%	21.9%	52.2%
	1	Count	18	25	43
		Expected Count	27.7	15.3	43.0
		% within PTBE	41.9%	58.1%	100.0%
		% within SEIZURE	31.0%	78.1%	47.8%
Total		Count	58	32	90
		Expected Count	58.0	32.0	90.0
		% within PTBE	64.4%	35.6%	100.0%
		% within SEIZURE	100.0%	100.0%	100.0%

Table 5b. Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	18.328[a]	1	.000		
Continuity Correction[b]	16.489	1	.000		
Likelihood Ratio	19.120	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	18.125	1	.000		
N of Valid Cases	90				

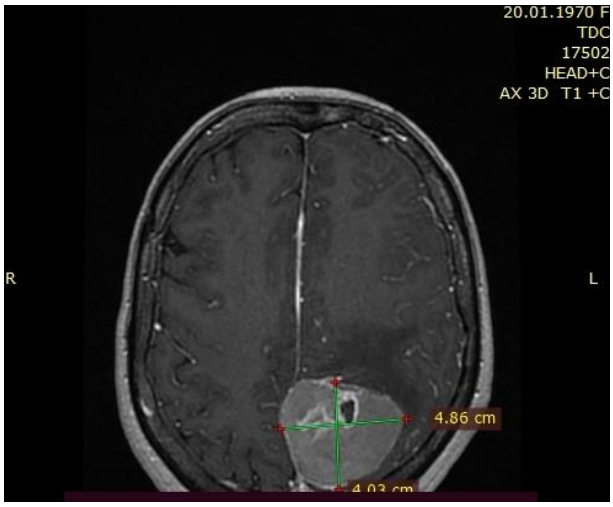
Chi-square statistics were used to examine association between categorical variables (Seizure and PTBE). There is a significant association at 5% significance level between seizure and PTBE of respondents (χ2=,18.328, df=1, p=0.000).

Clinical data

The preoperative clinical symptoms and signs (non-focal) like;, headache, vomiting, mental change, memory disorder and cognitive decline, were found in most cases 92(59.7%) patients for Group A", While second presentation was focal neurological deficit (FND), include; motor weakness, sensory , cranial nerves dysfunction, aphasia, were found in 78(50.6%). In this study, pre op seizure was the third presentation 65(42.2%), of these 32 patients were seizure was single presentation.

For Group B", non-focal was first presentation and occurs in 59(65.5%) patients, followed; focal symptoms 36(40%) patients, then seizure was the third presentation 32(35.5%) patients of these 12(37.5%) patients were seizure was single presentation. Clinical types of seizure in both groups was; complex partial in (158 patient, 64.8%), generalized tonic clonic (43 patients, 17.6%). Simple partial (23 patients, 9.5%) and combined (20 patients, 8.1%). (Figure1,2).

Focal neurological deficit were associated with reduced incidence of pre-op seizure, in both groups for Group A,16 (24,6%) patients with seizure compared to 62(69.7%) patients without seizure, and Group B, (7patients, 21.8% seizure vs, 29 patients, 50% without seizure). moreover, pre-op seizure was in 49.2% as a first presentation of disease compared to 50.2% for others in Group A, and 37.5% vs 62.5 for Group B".



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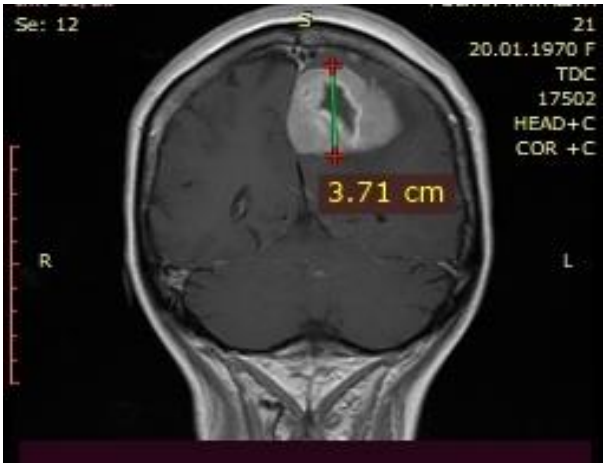

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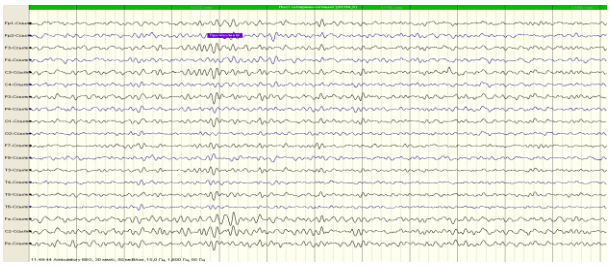
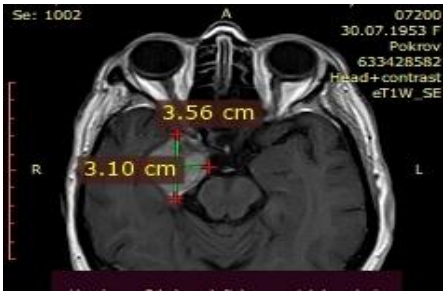


C.

Figure 1. A female patient aged 48 years, presented with fits, mental changes, and headache. (a) Axial and (b) coronal T1 with contrast showing left middle falx meningioma type I, hemispheroid tumor invagination deeply into one hemisphere. (c) Preoperative electroencephalography showing focal epileptiform activity in left parietal lobe.



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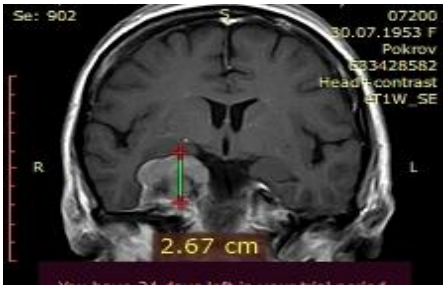

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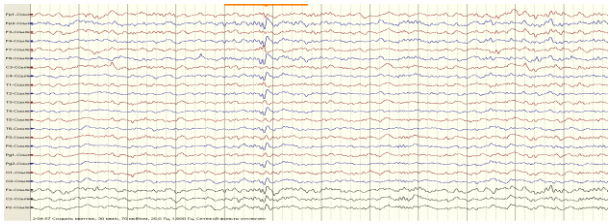

C.

Figure 2. (a) A female patient aged 65 years, presented with fits, headache, and vision impairment on right side (a) axial and (b) coronal T1 with contrast showing right medial sphenoid wing meningioma. (c) Preoperative electroencephalography showingfocal epileptiform activity in right hemisphere.

Histopathological finding

In our groups study (Table 6), pathological finding was found; Grade I were included 121 (78.6%) cases,(seizure 80% vs 77.5% non-seizure), Grade II in 24(15.6%) cases, (seizure 13.8% vs 16.8% non-seizure) and Grade III in 9(5.8%) cases, (seizure 6.2% vs 5.7%% non-seizure) for Group A. While for Group B", Gr.I in 75(83.3%)cases, (seizure 87.5% vs 81% non-seizure), GradeII in 13(14.4%) cases, (seizure 12.5% vs15.5% non-seizure), Grade III in 2(2.3%) cases ,(seizure 0% vs 3.6% non-seizure).

For both groups, meningothelial meningioma was the most common histopathological type, and angiomatous subtype had slightly higher occurrence of seizure 10(15.4%) cases compared to 5(5.6%) cases without seizure four Group A.

Table 6.

WHO Grade	**Group A**			**Group B**		
	No of Cases 154	Seizure 65	Non Seizure89	No of Cases90	Seizure 32	Non Seizure 58
WHO I meningiothelial	121 (78.6%) 53	52(80%) 21	69(77.5%) 32	75(83.3%) 44	28(87.5%) 15	47(81%) 29
fibroblast	33	14	19	11	3	8
transitional	10	3	7	6	3	3
angiomatous	15	10	5	8	4	4
psammomatous	9	3	6	5	3	2

microcyst	1	1	-	1	-	1
WHO II	24(15.6%)	9(13.8%)	15(16.8%)	13(14.4%)	4(12.5%)	9(15.5%)
WHO III	9(5.8%)	4(6.2%)	5 (5.7%)	2(2.3%)	-	2(3.6%)

Discussion

Seizures are one of the three most common clinical symptoms besides (and after) headache and focal neurological deficit of patients with meningioma [33]. In the present study, we report the risk factors associated with preoperative seizures in different locations of supratentorial meningiomas.

The occurrence of preop seizure for (NSBM) Group "A" was slightly higher (42.2% patients) as compared to (SBM) Group "B" (35.5% patients). Gender distribution in our study in both groups showed that was no statistically significant relationship between gender and preoperative seizure. p=0.396 and p=0.445 respectively. Similar results were reported by Islim Al et al [14] and Chozick et al. [9].

The epileptic patients in Group "A" have their tumor location mostly in frontal and temporal regions, however, there was no statistically significant relation between tumor related to brain lobes (site) and occurrence of a seizure, p=0638, also we could not find the difference between convexity and parasagittal/parafalcine for the occurrence of a seizure, p=0.503. While we observed an increase of seizure in SWM and OGM compared to planum/tuberclum meningiomas and the relation was significant p=0.050

According to most studies addressing this question were reported different results,Lieu et al. and Das et al. [10,17] identified temporal. Islimet al. [14] identified parietal meningiomas to be significantly associated with preoperative seizures. Skardelly et al. [28] further identified parafalcine meningiomas to be significantly associated with preoperative seizures. Kawaguchi et al.[15] who studied convexity meningioma found that there was a significant relationship between the seizure occurrence and tumor location. However, our result corresponds with other studies that were reported lacking significant relation between the seizure occurrence and tumor location and site. Liigant et al.[18] found that a higher incidence of seizures was in tumors involving the frontoparietal (58%), frontotemporal (44%), and temporal (40%) regions but no significant association with tumor location. Riva [24] and Hess K, et al., [13] found no statistically significant relation between tumor site and occurrence of seizure.

In our study, the distribution of tumor side in both groups showed that the left side was slightly higher than the right side, however, there was no statistically significant relationship between the side of the lesion and preoperative seizure, for both groups, (Gr. "A", p=0.836 and Gr." B", p=0.702. Our results were similar to what was reported by, Lieu and Howng [17]. Moreover, tumor side and a number of lesions had no significant influence on preoperative seizure rate [9,14].

The distribution of tumor size in both groups showed that there was no statistically significant relation between tumor size and the occurrence of seizures. Similar results were reported in three studies. [6,14,18]. In contrary to what was reported by other studies, were shown a positive correlation between tumor size and preoperative seizure rate [7,15,20,33].

Here, we showed that PTBE may be the factor most strongly related to preoperative seizures for both groups: A" and" B". ($\chi 2$=,15.356, p=0.000) and ($\chi 2$=,18.328, p=0.000), respectively. Various studies in the past have reported a correlation between vasogenic edema and seizure occurrences. [6,11,15,33]. Furthermore, Lieu and Howng[17], and Kawaguchiet al.[15]reported that most patients with evident or severe edema, had preoperative and postoperative epilepsy with a significant correlation.

Despite primarily extra-axial locations, slow progression rates, and usually benign histological characteristics, meningiomas frequently are associated with PTBE [4]. PTBE, as assessed on CT scan, has been found to be associated with more than half of the cases [16]. Though the exact mechanism involved in the development of PTBE is not known, several factors have been previously studied like tumour location and tumour volume, interleukin-6, sex hormone receptors and several others [1,2,21]. Moreover, peritumoral edema fluid contains a high concentration of glutamate, which may trigger hyperexcitability and epileptogenesis [34].

The preoperative seizure was the third clinical symptom after non-focal and focal symptoms in both groups of patients respectively. Moreover, the

pre-op seizure was in 49.2% as the first presentation of disease compared to 50.2% for focal and non-focal symptoms for the non-skull base, and 37.5% vs 62.5 for skull base meningiomas. In the literature review; it was reported that 19-63% of the patients with meningioma are suffered from preoperative seizures, and 35% of them experience epileptic seizures as the initial symptom [19].

In our data presence of preoperative neurologic deficits has been less frequently associated with preoperative seizures in both groups: Group "A" patients,(seizure in 16 cases 24.6% vs 62 cases 69.7% non-seizure), Group "B" patients, (seizure 7 cases, 21.8% vs 29 cases 50% without seizure). This is an unexpected finding. However, considering the increase in meningioma detection and widespread availability of neuroimaging [22], this may be explained by the diagnosis of the tumor prior to the occurrence of neurological deficits or just after a seizure attack. Furthermore, by Riva study (among seizure in intrinsic brain tumors), he reported that patients with seizures showed a significantly lower incidence of neurological deficit, headache, and mental disturbances compared with nonepileptic patients [24]. Otherwise, Careful analysis and further investigation are needed.

The distribution of tumor histopathology in both groups showed that meningothelial meningioma was the most common histopathological type. While high grade (GrII-III) was higher in non-skull base (21.4%) than skull base (16.7%). Despite the increased occurrence of pre-op seizure among angiomatous type, however, there was no relation between the different histopathological types and occurrence of seizure. Kawaguchiet al. [15] believed that fibroblastic meningiomas were significantly correlated with preoperative seizures. Skardelly et al. demonstrated an increase of preoperative seizures from WHO Gr. II and Gr.III [28] Chowet al.[8]showed that the histologic types were not significantly correlated with preoperative seizure. Moreover, in other studies did not have a significant influence on pre-or postoperative seizure rate [5,9].

Conclusion

We identified that the major risk factor for pre-op seizure in both groups study is PTBE, and location for skull base meningiomas, where the planum/tuberculum lesser overall risk for pre-op seizure. There was a trend for the occurrence of preoperative seizure among (male gender in skull base and female gender in non-skull base), frontal, temporal, left side, and size <5 cm and angiomatous subtype, however, these predictors were statistically insignificant. The factor associated with preoperative seizures were the absence of preoperative neurologic deficit for both groups. Careful analysis and further investigation are needed.

Abbreviations

SWM: Sphenoid Wing Meningiomas;
OGM: Olfactory Groove Meningioma;
CT: Computer Tomography;
MRI: Magnetic Resonance Imaging;
PTBE: Peritumoral Brain Oedema;
FND: Focal Neurological Deficit;
WHO: World Health Organization;
CNS: Central Nervous System;
SBM: Skull Base Meningioma;
NSBM: Non-Skull Base Meningioma;
EEG: Electro Encephalo Graphy;
CS: Cavernous Sinus.

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